CENTERS FOR DISEASE CONTROL

Vol. 35/No. 1SS

MMWR

MORBIDITY AND MORTALITY WEEKLY REPORT

CDC Surveillance Summaries 1986

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333

CDC Surveillance Summaries are published by the Epidemiology Program Office, Centers for Disease Control, Public Health Service, U.S. Department of Health and Human Services, Atlanta, Georgia 30333.

SUGGESTED CITATIONS

General: Centers for Disease Control. *CDC Surveillance Summaries. MMWR* 1986;35(No. 1SS).

Specific: Centers for Disease Control. [Title of particular article/chapter.] In: *CDC Surveillance Summaries. MMWR* 1986;35(No. 1SS):[inclusive page numbers].

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Foreword

The purpose of the *CDC Surveillance Summaries* is to make available the most current information on conditions of public health interest for which CDC has major responsibility. The *CDC Surveillance Summaries* provide detailed analysis of the most current available data obtained for CDC surveillance programs. These reports complement other data published by CDC in the *Morbidity and Mortality Weekly Report (MMWR),* the *MMWR Annual Summary,* and various disease-surveillance reports. This volume contains epidemiologic information derived from surveillance forms, special investigations, and other sources of information collected at the state and national levels.

History of CDC Surveillance Activities

CDC has been actively involved in disease-surveillance activities since the formation of the Communicable Disease Center in 1946. The original scope of the National Surveillance Program included the study of malaria, murine typhus, smallpox, psittacosis, diphtheria, leprosy, and sylvatic plague. In 1954, a surveillance section was established within the Epidemiology Branch of CDC, primarily concerned with planning and conducting continuing surveillance and making periodic reports. National emergencies such as the Asian influenza pandemic and the discovery of Legionnaires' disease have prompted the involvement of CDC in new surveillance activities. Over the years the surveillance activities of CDC have expanded to include not only new areas in infectious disease but also programs in human reproduction, environmental health, chronic disease, risk reduction, and occupational safety and health. Ongoing evaluation of these programs has led to new methods of data collection and analysis and has prompted examination of how data are disseminated to the public health community.

In 1980 and 1981, a survey of CDC staff and state epidemiologists suggested that improved coordination of surveillance reports with the *MMWR* and the *MMWR Annual Summary* would facilitate timely publication; provide greater uniformity in the acquisition, evaluation, and reporting of surveillance data; and encourage use of these data. Several approaches to the development of a systematic process of disseminating disease-specific surveillance reports were considered. On the basis of considerations of timeliness, cost advantages, and editorial uniformity, a report published on a quarterly basis was recommended. Subsequent financial and personnel constraints have made it necessary to publish these reports less frequently.

The *CDC Surveillance Summaries* contain information more reflective of the detailed surveillance reports of the past. CDC hopes that the *Surveillance Summaries* will disseminate surveillance data on a regular schedule, improve the clarity of community public health information, and also produce a cost savings. Although the *CDC Surveillance Summaries* are published more often than once a year, they will typically contain annual data rather than interim data. The *MMWR Annual Summary* will complement rather than serve as the cumulative summary of the *Surveillance Summaries*.

Data Sources

Data on the reported occurrence of notifiable diseases are derived from reports supplied by the state and territorial departments of health and CDC program activities, routinely published in the *MMWR*, and compiled in final form in the *MMWR Annual Summary*.

CDC also maintains national surveillance programs for selected diseases with the cooperation of state and local health departments as well as other federal agencies, and publishes detailed epidemiologic analyses periodically. Data appearing in the *CDC Surveillance Summaries* or in a surveillance report may not agree exactly with reports published in the *MMWR* because of differences in timing of reports or because of refinements in case definition. It should be noted that data collected for the *MMWR* and the more detailed data published by individual CDC programs are collected independently.

These data should be interpreted with caution. Some diseases that cause severe clinical illness and are associated with serious consequences are probably reported quite accurately. However, diseases that are clinically mild and infrequently associated with serious consequences are less likely to be reported. Additionally, subclinical cases are seldom detected except in the course of epidemic investigations or special studies. The degree of completeness of reporting is also influenced by the diagnostic facilities available, the control measures in effect, and the interests and priorities of state and local officials responsible for disease control and surveillance. Finally, factors such as the introduction of new diagnostic tests and the discovery of new disease entities may cause changes in disease reporting independent of the true incidence of disease. Despite these limitations the data in these reports have proven to be useful in the analysis of trends.

Surveillance Programs
Centers for Disease Control

Surveillance program	Responsible branch	Most recent report/summary*
Abortion	Pregnancy Epidemiology Branch Division of Reproductive Health Center for Health Promotion and Education	November 1985 (1981 data)
Behavioral risk factors	Division of Nutrition Center for Health Promotion and Education	1984 (SS 33/1) (data from 1981-1983)
Berylliosis cohorts: registry of disease and exposure	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	March 1983 (data from 1951-1980)
Biologics	Data Management Branch Division of Immunization Center for Prevention Services	December 1982 (1982 data)
Botulism	Enteric Diseases Branch Division of Bacterial Diseases Center for Infectious Diseases	May 1979 (data from 1899-1977)
Brucellosis	Bacterial Zoonoses Activity Division of Bacterial Diseases Center for Infectious Diseases	June 1979 (1978 data)
Coal workers' pneumoconiosis	Epidemiological Investigations Branch Division of Respiratory Disease Studies National Inst. for Occup. Safety & Hlth.	1985 (SS 34/1) (data from 1970-1981)
Congenital malformations	Birth Defects Branch Chronic Diseases Division Center for Environmental Health	1985 (SS 34/2) (data from 1970-1983)
Dengue	Dengue Branch Division of Vector-Borne Viral Diseases Center for Infectious Diseases	1985 (SS 34/2) (data from 1983-1984)
Diabetes	Division of Diabetes Control Center for Prevention Services	June 1979 (1978 data)
Diphtheria	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	July 1978 (data from 1971-1975)
Ectopic pregnancy	Pregnancy Epidemiology Branch Division of Reproductive Health Center for Health Promotion and Education	1984 (SS 33/2) (data from 1979-1980)

*Publications denoted by "SS" appeared in issues of *CDC Surveillance Summaries*. Other reports listed can be obtained by contacting the responsible administrative unit listed.

Surveillance Programs
Centers for Disease Control

Surveillance program	Responsible branch	Most recent report/summary*
Encephalitis	Arbovirus Reference Branch Division of Vector-Borne Viral Diseases Center for Infectious Diseases	May 1981 (1978 data)
Enterovirus	Respiratory and Enterovirus Branch Division of Viral Diseases Center for Infectious Diseases	November 1981 (data from 1970-1979)
Fifteen leading causes of death in the U.S., 1978	Health Analysis and Planning for Preventive Services Center for Prevention Services	September 1982 (1978 data)
Foodborne disease	Enteric Diseases Branch Division of Bacterial Diseases Center for Infectious Diseases	1985 (SS 34/3) (1982 data)
Gonorrhea	Division of Sexually Transmitted Diseases Center for Prevention Services	1984 (SS 33/4) (data from 1983-1984)
Hepatitis	Hepatitis Branch Division of Viral Diseases Center for Infectious Diseases	1985 (SS 34/1) (data from 1982-1983)
Homicide	Violence Epidemiology Branch Office of the Director Center for Health Promotion and Education	May 1983 (SS 32/2) (data from 1970-1978)
Hysterectomy	Epidemiologic Studies Branch Division of Reproductive Health Center for Health Promotion and Education	1985 (SS 34/3) (data from 1981-1982)
Influenza	Influenza Branch Division of Viral Diseases Center for Infectious Diseases	July 1984 (data from 1983-1984)
Lead poisoning in workers	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	April 1983 (data from 1976-1980)
Leprosy	Respiratory and Special Pathogens Branch Division of Bacterial Diseases Center for Infectious Diseases	April 1976 (data from 1971-1973)
Leptospirosis	Bacterial Zoonoses Activity Division of Bacterial Diseases Center for Infectious Diseases	August 1979 (1978 data)

*Publications denoted by "SS" appeared in issues of *CDC Surveillance Summaries*. Other reports listed can be obtained by contacting the responsible administrative unit listed.

Surveillance Programs
Centers for Disease Control

Surveillance program	Responsible branch	Most recent report/summary*
Malaria	Malaria Branch Division of Parasitic Diseases Center for Infectious Diseases	October 1984 (1983 data)
Maternal mortality	Division of Reproductive Health Center for Health Promotion and Education	1984 (SS 33/1) (data from 1974-1978)
Measles	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	September 1982 (data from 1977-1981)
Mumps	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	July 1978 (data from 1974-1976)
National electronic injury surveillance system	Safety Surveillance Branch Division of Safety Research National Inst. for Occup. Safety & Hlth.	May 1983 (SS 32/2) (1982 data)
National Occupational Hazard Survey (NOHS)	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	NIOSH Technical Report DHHS (NIOSH) Pub. No. 83-117
Nosocomial infections	National Nosocomial Infections Surveillance System Hospital Infections Program Center for Infectious Diseases	1985 (SS 34/3) (1984 data)
Nutrition	Division of Nutrition Center for Health Promotion and Education	November 1982 (1980 data)
Occupational characteristics of disabled workers	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	July 1980 (data from 1969-1978)
Occupational hazard surveillance	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	1985 (SS 34/2) (data from 1970-1982)
Occupational injuries among loggers	Safety Surveillance Branch Division of Safety Research National Inst. for Occup. Safety & Hlth.	August 1983 (SS 32/3) (data from 1969-1974)

*Publications denoted by "SS" appeared in issues of *CDC Surveillance Summaries*. Other reports listed can be obtained by contacting the responsible administrative unit listed.

Surveillance Programs
Centers for Disease Control

Surveillance program	Responsible branch	Most recent report/summary*
Occupational injuries in the meatpacking industry	Safety Surveillance Branch Division of Safety Research National Inst. for Occup. Safety & Hlth.	1985 (SS 34/1) (data from 1976-1981)
Occupational mortality in Washington State	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	DHHS (NIOSH) Pub. No. 83-116 (data from 1950-1979)
Pediatric nutrition	Division of Nutrition Center for Health Promotion and Education	1983 (SS 32/4) (1982 data)
Pelvic inflammatory disease	Division of Sexually Transmitted Disease Center for Prevention Services	1983 (SS 32/4) (data from 1965-1982)
Plague	Plague Branch Division of Vector-Borne Viral Diseases Center for Infectious Diseases	1985 (SS 34/2) (1984 data)
Poliomyelitis	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	December 1982 (data from 1980-1981)
Psittacosis	Bacterial Zoonoses Activity Division of Bacterial Diseases Center for Infectious Diseases	February 1983 (SS 32/1) (1979 data)
Rabies	Viral and Rickettsial Zoonoses Branch Division of Viral Diseases Center for Infectious Diseases	1985 (SS 34/1) (1983 data)
Reye syndrome	Epidemiology Office Division of Viral Diseases Center for Infectious Diseases	1984 (SS 33/3) (1983 data)
Rickettsial disease (RMSF, murine typhus, Q fever, endemic typhus)	Viral and Rickettsial Zoonoses Branch Division of Viral Diseases Center for Infectious Diseases	May 1981 (1979 data)
Rocky mountain spotted fever	Viral and Rickettsial Zoonoses Branch Division of Viral Diseases Center for Infectious Diseases	1984 (SS 33/3) (data from 1981-1983)
Rubella	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	1984 (SS 33/4) (1983 data)

*Publications denoted by "SS" appeared in issues of *CDC Surveillance Summaries*. Other reports listed can be obtained by contacting the responsible administrative unit listed.

Surveillance Programs
Centers for Disease Control

Surveillance program	Responsible branch	Most recent report/summary*
Salmonella	Enteric Diseases Branch Division of Bacterial Diseases Center for Infectious Diseases	December 1982 (1980 data)
Sentinel health event (occupational) (SHE)	Surveillance Branch Division of Surveillance, Hazard Evaluations, and Field Studies National Inst. for Occup. Safety & Hlth.	September 1983
Summer mortality	Special Studies Branch Chronic Diseases Division Center for Environmental Health	February 1983 (SS 32/1) (data from 1979-1981)
Surgical sterilization	Epidemiologic Studies Branch Division of Reproductive Health Center for Health Promotion and Education	August 1983 (SS 32/3) (data from 1979-1980)
Toxic-shock syndrome	Respiratory and Special Pathogens Branch Division of Bacterial Diseases Center for Infectious Diseases	1984 (SS 33/3) (data from 1960-1984)
Trichinosis	Helminthic Diseases Branch Division of Parasitic Diseases Center for Infectious Diseases	1984 (SS 33/4) (1983 data)
Tuberculosis	Division of Tuberculosis Control Center for Prevention Services	July 1985 (1984 data) TB Statistics: States & Cities November 1983 (1980 data) TB in the United States
U.S. immunization survey	Surveillance, Investigations and Research Branch Division of Immunization Center for Prevention Services	April 1983 (data from 1979-1982)
Venereal disease	Division of Sexually Transmitted Disease Center for Prevention Services	(1980 data) Sexually Transmitted Diseases Statistical Letter-No. 130 (data from 1978-1979) STD Fact Sheet-Edition 35
Water-related disease outbreaks	Enteric Diseases Branch Division of Bacterial Diseases Center for Infectious Diseases	September 1984 (1983 data)

*Publications denoted by "SS" appeared in issues of *CDC Surveillance Summaries*. Other reports listed can be obtained by contacting the responsible administrative unit listed.

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Hysterectomy among Women of Reproductive Age, United States, Update for 1981-1982

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Introduction

Nearly 5 million American women underwent hysterectomy in the last decade, making this procedure one of the most frequently performed operations for women of reproductive age (*1*) and an important public health concern. Since 1970, CDC has provided epidemiologic surveillance of hysterectomies performed on women 15-44 years of age; summary data have been previously published (*2-4*). This report provides an analysis of the influence of age, race, geographic region, and surgical approach on hysterectomy rates for 1981-1982 and updates the analysis of hysterectomy rates for 1970-1980 (*4*). This previous analysis showed that the nationwide hysterectomy rate declined from 1975 to 1980 among women of reproductive age. The current analysis, however, indicates that the noted decline may have begun to plateau, although rates in 1982 were the lowest since 1970. Major differences in rates by region and age and in the percentage of hysterectomies performed by the vaginal route have persisted. In 1982, for the first time since surveillance began in 1970, blacks had a lower hysterectomy rate than whites.

Methods

The methods of this study have been described in detail elsewhere (*2*). In brief, the data were collected by the National Center for Health Statistics (NCHS) as part of the ongoing National Hospital Discharge Survey (NHDS), which estimates the number and characteristics of patients admitted to U.S. non-Federal, short-stay hospitals for surgical procedures, disease, or injury. For this and previous reports, only total and subtotal hysterectomies with or without concomitant oophorectomy were included; radical hysterectomies and pelvic exenteration were excluded.

The population estimates used in computing rates for this report were based on data from current population surveys conducted by the U.S. Bureau of the Census. Data on race were grouped into the categories of white and black, the latter category including all races other than white. In 1981, NCHS did not report the percentage of hysterectomies classified as unknown for race. Prior to release of data, unknowns were redistributed between the categories of white and black based on the distribution of race in the geographic area of the hospital and on information on the diagnoses and expected source of payment indicated on those records for which race was reported (*5*). This was not done for the 1982 data. In 1982, as for all previous years except 1981, CDC redistributed the 9% of hysterectomies classified as unknown for race according to the percentage of knowns for race in that year (*2-4*).

Results

In the period 1970-1982, an estimated 5,170,000 women 15-44 years of age underwent hysterectomy in U.S. non-Federal, short-stay hospitals. The number of hysterectomies increased from a low of 306,000 in 1970 to a high of 442,000 in 1977 and then declined to 421,000 in 1981 and 407,000 in 1982 (Figure 1).

The hysterectomy rate in 1981 was 7.9/1,000 women ages 15-44 years and in 1982 was 7.5, the lowest rate since 1970 (Figure 2). From 1970 to 1981, the hysterectomy rate for black women was higher than that for white women. However, in 1982, for the first time since surveillance began in 1970, the rate for black women, 6.7/1,000, was less than the 7.7 rate for white women. From 1975 to 1982, the hysterectomy rate declined 14% for whites and 34% for blacks. In the period 1981-1982, the average age at the time of hysterectomy was 35 years for both blacks and whites.

For the period 1981-1982, as in previous years, the highest hysterectomy rate for women of reproductive age was for the 35- to 44-year age group, and the lowest was for the 15- to 24-year age group (Figure 3). In 1982, approximately one in 63 women 35-44 years of age underwent a hysterectomy. This is a conservative estimate because women who had had hysterectomies in previous years were not removed from the denominator.

Hysterectomy rates also varied by region during this period (Figure 4). As in previous years, women in the Northeast had the lowest hysterectomy rate of the four regions, whereas women in the South had the highest rate. The hysterectomy rate for women in the South was 2.5 times that for women in the Northeast. The average age at time of hysterectomy was similar in all geographic areas, ranging from 34.2 years in the South to 36.6 years in the Northeast.

FIGURE 1. Number of hysterectomies performed in hospitals on women ages 15-44 years, United States, 1970-1982

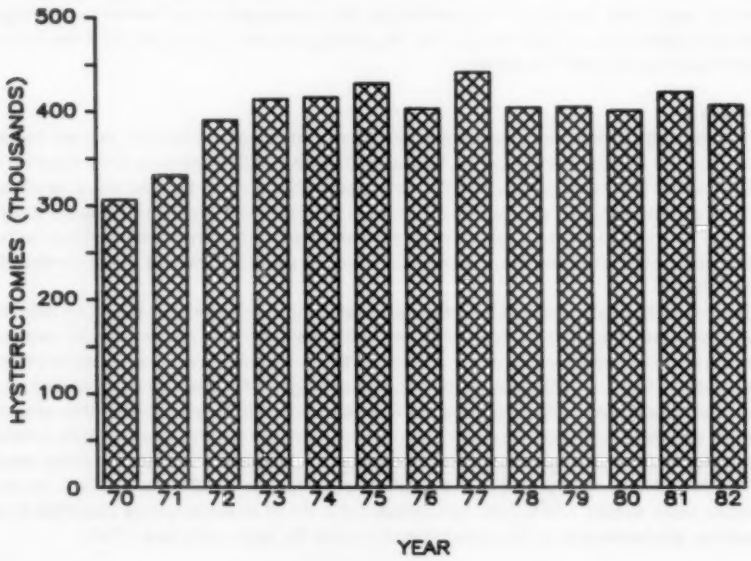


FIGURE 2. Hysterectomy rates by race, United States, 1970-1982

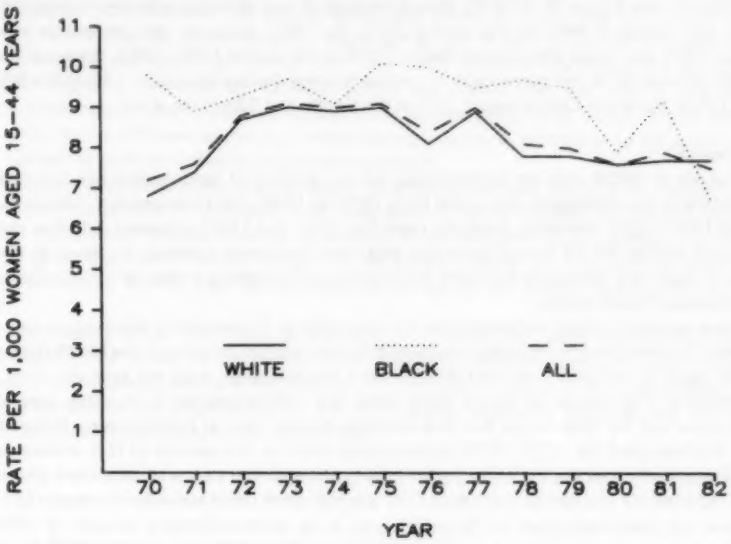
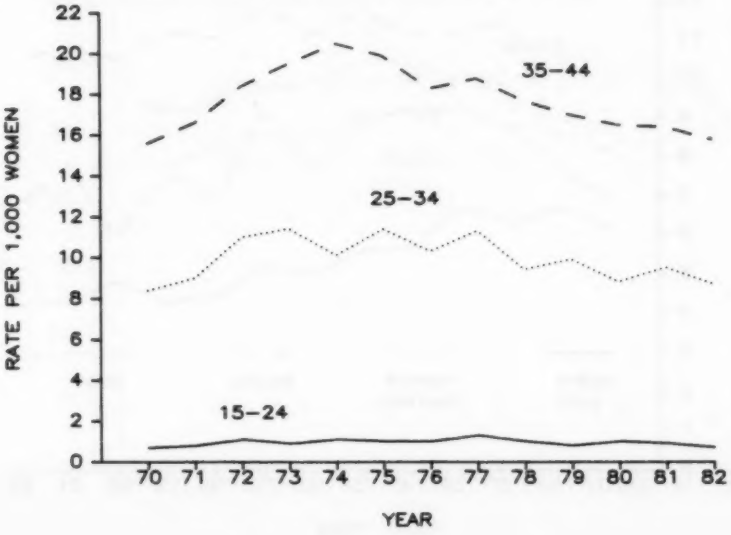


FIGURE 3. Hysterectomy rates by age group, United States, 1970-1982



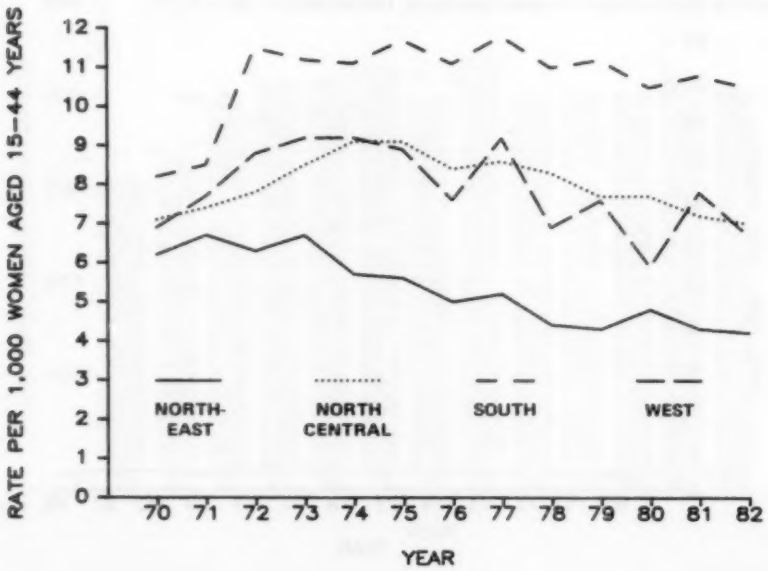
In 1981 and 1982, 27% and 24%, respectively, of all hysterectomies were performed by the vaginal route (Figure 5). In 1970, the percentage of vaginal hysterectomies among whites (27%) was similar to that among blacks (25%). By 1982, however, the percentage among whites (26%) was twice that among blacks (13%). In the period 1981-1982, there were substantial differences in the percentage of vaginal hysterectomies by region: 14% in the Northeast, 23% in the North Central region, 27% in the South, and 33% in the West.

Discussion

Analysis of NHDS data on hysterectomy among women of reproductive age shows that the decline in the nationwide rate noted from 1975 to 1980 may have begun to plateau in the period 1981-1982. However, since the rates for 1981 and 1982 represent only two annual estimates among the 13 annual estimates that have now been reported, it cannot be ascertained if these new estimates represent the beginning of a plateau in rates or a continuation of the previously noted decline.

These results probably underestimate the true rates of hysterectomy because women undergoing hysterectomy in Federally operated hospitals are not included in the NHDS data, and women ages 15-44 years who had already had a hysterectomy were not excluded from the denominator. The degree to which these rates are underestimated is probably greater in those areas and for those ages that had relatively higher rates of hysterectomy. However, a study that adjusted the 1971-1978 hysterectomy rates for the number of U.S. women ages 15-44 years who had already had a hysterectomy showed that trends in rates were similar to those reported for this period in previous CDC surgical sterilization surveillance reports (*6*).

FIGURE 4. Hysterectomy rates by geographic region, United States, 1970-1982

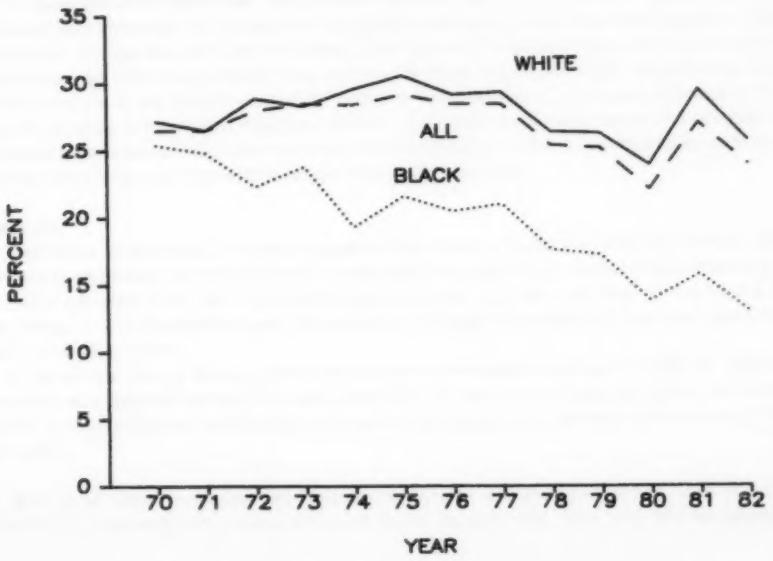


During 1979-1980, differences in hysterectomy rates between blacks and whites declined noticeably. In 1981, however, the rates of blacks and whites diverged, only to converge again in 1982. The instability of race-specific rates may be due, in part, to the two different methods of imputing unknowns for race in 1981 and 1982. Similarly, the divergence in percentages of vaginal hysterectomies between blacks and whites that was seen in the period 1981-1982 may be due to unstable race-specific hysterectomy rates, which, in turn, may be due either to the different methods of redistributing unknowns for race or to the small absolute number of hysterectomies among blacks surveyed.

Variations in hysterectomy rates by region have persisted since 1970 (*2-4*). Factors related to both patients and physicians may contribute to these regional differences. Patient-related factors may include regional differences in the incidence of gynecologic conditions and in general attitudes toward surgery or sterilization during the reproductive years (*7*). Physician-related factors may include regional differences in trends in training and practice (*8,9*).

In conclusion, while 1982 national and regional hysterectomy rates reached their lowest level since 1970, those for the period 1981-1982 may represent either the beginning of a plateau or a continued decline in rates since 1975. Further surveillance of hysterectomy rates among women of reproductive age in U.S. non-Federal, short-stay hospitals will determine the direction of these trends in the early 1980s.

FIGURE 5. Vaginal hysterectomies as a percentage of all hysterectomies for women ages 15-44 years, by race, United States, 1970-1982



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Foodborne Disease Outbreaks, Annual Summary, 1982

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Introduction

Foodborne disease surveillance has traditionally served three objectives:

1. **Disease Prevention and Control**. Early identification and removal of contaminated products from the commercial market, correction of faulty food preparation practices in food service establishments and in the home, and identification and appropriate treatment of human carriers of foodborne pathogens are the main prevention and control measures that result from surveillance of foodborne disease.

2. **Knowledge of Disease Causation**. In over half of the foodborne disease outbreaks reported to CDC in each of the last 5 years, the responsible pathogen was not identified. In many of these outbreaks, pathogens known to cause foodborne illness may not have been identified because laboratory investigations were late or incomplete. In others, the responsible pathogen may have escaped detection even after thorough laboratory investigation, either because the pathogen may not have been recognized as a cause of foodborne disease or because the pathogen could not be identified by available laboratory techniques. When more thorough clinical, epidemiologic, and laboratory investigations are conducted, perhaps many of these pathogens can be identified, and suitable measures for prevention and control can be instituted.

3. **Administrative Guidance**. The collection of data from investigations of foodborne disease outbreaks permits the assessment of trends in the prevalence of etiologic agents and in vehicles of disease transmission. In addition, it brings to light common errors in food handling. Compiling and publishing annual data will enable local and state health departments and others involved in the implementation of food protection programs to be kept informed of the factors involved in foodborne disease outbreaks. Comprehensive surveillance should result in a greater awareness of the most important food protection methods, the institution of better training programs, and more effective use of available resources.

Methods

Definition of Outbreak. For the purpose of this report, a foodborne disease outbreak was defined as an incident in which 1) two or more persons experience a similar illness after ingestion of a common food, and 2) epidemiologic analysis implicates the food as the source of the illness. A few exceptions exist; for example, one case of botulism or chemical poisoning constitutes an outbreak.

Outbreaks of known etiology are those for which laboratory evidence of a specific agent is obtained and specified criteria are met. Outbreaks of unknown etiology are those for which epidemiologic evidence implicates a food source, but adequate laboratory confirmation is not obtained.

Source of Data. Outbreaks are reported to CDC on a standard reporting form. Reports come most frequently from state and local health departments; they may also be received

from Federal agencies such as the Food and Drug Administration (FDA), the U.S. Department of Agriculture (USDA), the U.S. Armed Forces, and occasionally from private physicians. Forms are reviewed at CDC to determine whether a specific etiologic agent for the outbreak can be confirmed and, in some instances, questions about an etiologic agent may be referred back to the reporting agency. Otherwise, data are accepted as reported.

Interpretation of Data. The limitations on the quantity and quality of data presented here must be recognized in order to avoid misinterpretation. The number of outbreaks of foodborne disease reported by this surveillance system clearly represents only a small fraction of the total number that occur. The likelihood of an outbreak's coming to the attention of health authorities is dependent on consumers' and physicians' awareness, their interest, and their motivation to report the incident. For example, large outbreaks; interstate outbreaks; restaurant-associated outbreaks; and outbreaks involving serious illnesses, hospitalizations, or deaths are more likely to come to the attention of health authorities than cases of mild illness following a family cookout.

The quality of the data presented here depends upon the commitment to surveillance of this type of disease by state or local health departments. A department's interest in foodborne disease, its investigative capabilities, and its laboratory facilities are important determinants of the quality of the investigation. Furthermore, the likelihood that the findings of the investigation will be reported varies from one locality to another. This report, then, should not be the basis of firm conclusions about the absolute incidence of foodborne disease, and it should not be used to draw conclusions about the relative incidence of foodborne diseases by specific causes. For example, foodborne diseases characterized by short incubation periods, such as those caused by a chemical agent or staphylococcal enterotoxin, are more likely to be recognized in common-source foodborne disease outbreaks than those diseases with longer incubation periods, such as hepatitis A. Outbreaks involving less common pathogens, such as *Bacillus cereus*, *Escherichia coli*, or *Giardia lamblia* are less likely to be confirmed because these organisms are often not considered in clinical, epidemiologic, and laboratory investigations of foodborne disease outbreaks. Also, since laboratory methods for confirming viral disease are not widely available, many outbreaks of foodborne illness due to viruses probably fall into the "unknown etiologic agent" category. Pathogens that generally cause mild illness will be underrepresented, while those causing serious illness, such as *Clostridium botulinum*, are more likely to be identified. Similarly, restaurant- or commercial-product-associated outbreaks have a higher likelihood of being reported.

Results

In 1982, 656 outbreaks (19,380 cases) of foodborne disease were reported to CDC. Reports were received from 39 states as well as from the District of Columbia, the U.S. Virgin Islands, Guam, and Puerto Rico (Figure 1). New York reported the largest number of outbreaks (323), with 160 from New York City; Washington reported the next largest number of outbreaks (44), followed by California (35).

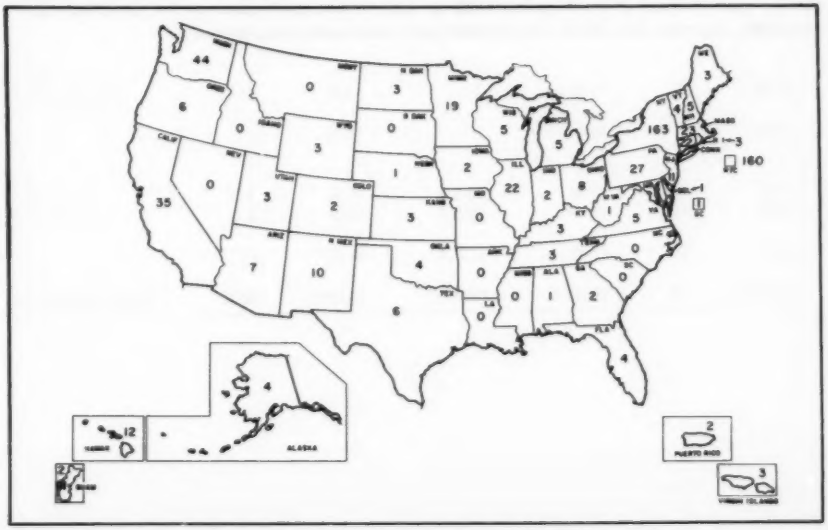
The etiologic agent was confirmed in 34% of the outbreaks (11,050 cases) (Table 1). Bacterial pathogens accounted for 151 outbreaks (5,501 cases). The most frequently isolated bacterial pathogen was *Salmonella* (55 outbreaks, 2,056 cases), followed by *Staphylococcus aureus* (28 outbreaks, 669 cases) and *Clostridium perfringens* (22 outbreaks, 1,189 cases). During 1982, two outbreaks (one in Oregon and one in Michigan) of a previously unrecognized pathogen, *E. coli* O157:H7, were investigated. Both outbreaks were associated with eating hamburger from the same fast-food restaurant chain. The illness was characterized by

bloody diarrhea, abdominal cramps, and low-grade or absent fever. Since it was first described, this pathogen has also been associated with non-bloody diarrhea and a spectrum of clinical illnesses, including hemolytic-uremic syndrome. Viral agents (hepatitis A and Norwalk virus) accounted for 21 outbreaks (5,325 cases). The high number of cases resulting from viral agents is predominantly due to two large outbreaks of Norwalk gastroenteritis that occurred in Minnesota. One outbreak involved 3,000 cases and was related to eating bakery items with frosting. The second involved 2,000 cases and was associated with eating cole slaw. Chemical agents were responsible for 47 outbreaks (220 cases). Only one outbreak, involving four persons with *Trichinella spiralis*, was attributed to a parasitic agent. Twenty-six deaths were associated with foodborne diseases in 1982: 11 from *Vibrio cholerae* O1 (all in Guam and the Trust Territories), eight from *Salmonella*, five from *C. botulinum*, and two from unknown causes. No pathogen was identified in 436 of the outbreaks (8,330 cases) reported in 1982.

Incubation periods were known for illnesses in 412 of the outbreaks. In 13 outbreaks, the incubation period was less than 1 hour; in 123 outbreaks, it was 1-7 hours; in 91 outbreaks, it was 8-14 hours; and in 185 outbreaks, it was 15 hours or more.

The food vehicle of transmission was determined in 168 (76%) of the 220 outbreaks in which a pathogen was identified (Table 2). For diseases caused by bacterial pathogens, meat or dairy products were the vehicles of transmission in 52% of the outbreaks in which the vehicle was known. For diseases caused by chemicals, fish or shellfish were the vehicles of transmission in 57% of the outbreaks. Food eaten in a restaurant was associated with 44% of outbreaks, and food eaten at home, with 30% (Table 3). The proportion of foodborne illness due to known etiologic agents was higher in the summer months than at any other time of year (Table 4).

FIGURE 1. Outbreaks of foodborne disease reported to CDC, by state, 1982



Discussion

The inconsistency in reporting can be seen by looking at the distribution of outbreaks by state. A few states, such as New York and Washington, reported a disproportionately large number of outbreaks. For example, New York State and New York City reported 323 outbreaks, almost one-half of those reported for the entire United States. While it is possible that states such as New York and Washington have a higher rate of foodborne disease, it is more likely that these figures simply represent differences in surveillance activity. The same inconsistency can be seen when looking at outbreaks by pathogen. CDC data show that *C.botulinum* is as common a foodborne pathogen as *Campylobacter jejuni* and *Vibrio parahaemolyticus*, a finding that indicates only that botulism is reported more comprehensively than some other pathogens.

The number of outbreaks of foodborne disease of confirmed etiology that were reported to CDC over the last 5 years has remained relatively constant. The distribution of cases by etiologic agent has also remained fairly consistent. Etiologic agents typically have been confirmed in about 40% of all outbreaks. When etiologic agents have been confirmed, bacterial pathogens have consistently accounted for approximately two-thirds of the outbreaks, and chemical agents for an additional 20%-25%.

Many food preparation practices contribute to foodborne disease (Table 5). In 1982, the five most common practices, in order of frequency of occurrence, included 1) improper holding temperature, 2) food from an unsafe source, 3) inadequate cooking, 4) poor personal hygiene on the part of food handlers, and 5) contaminated equipment. In most of the outbreaks caused by bacterial pathogens, the food had been stored at improper holding temperatures. In outbreaks of botulism or trichinosis, the food had usually been inadequately cooked. In outbreaks of ciguatera and mushroom poisoning, the food itself was unsafe, and illness was not related to improper handling or preparation.

The large number of outbreaks in which no pathogen was identified points out the need for the improvement of investigative skills so that known pathogens can be identified more frequently, and new and as-yet-unidentified pathogens can be recognized.

TABLE 1. Confirmed foodborne disease outbreaks, cases, and deaths, by etiologic agents, United States, 1982

Etiologic agent	Outbreaks		Cases		Deaths	
	No.	(%)	No.	(%)	No.	(%)
BACTERIAL						
Bacillus cereus	8	(3.6)	200	(1.8)	0	(0.0)
Brucella	1	(0.5)	3	(< 0.1)	0	(0.0)
Campylobacter jejuni	2	(0.9)	31	(0.3)	0	(0.0)
Clostridium botulinum	21	(9.5)	30	(0.3)	5	(20.9)
Clostridium perfringens	22	(10.0)	1,189	(10.8)	0	(0.0)
Escherichia coli	2	(0.9)	47	(0.4)	0	(0.0)
Salmonella	55	(25.0)	2,056	(18.6)	8	(33.3)
Shigella	4	(1.8)	116	(1.1)	0	(0.0)
Staphylococcus aureus	28	(12.7)	669	(6.0)	0	(0.0)
Streptococcus Group A	1	(0.5)	34	(0.3)	0	(0.0)
Vibrio cholerae O1	1	(0.5)	892	(8.0)	11	(45.8)
Vibrio cholerae non-O1	1	(0.5)	7	(0.1)	0	(0.0)
Vibrio parahaemolyticus	3	(1.4)	39	(0.4)	0	(0.0)
Yersinia enterocolitica	2	(0.9)	188	(1.7)	0	(0.0)
Total	151	(68.7)	5,501	(49.9)	24	(100.0)
CHEMICAL						
Ciguatoxin	8	(3.6)	37	(0.3)	0	(0.0)
Heavy metals	5	(2.3)	26	(0.2)	0	(0.0)
Monosodium glutamate	3	(1.4)	10	(0.1)	0	(0.0)
Mushrooms	4	(1.8)	9	(0.1)	0	(0.0)
Scombrotoxin	18	(8.2)	58	(0.5)	0	(0.0)
Shellfish	1	(0.5)	5	(< 0.1)	0	(0.0)
Other	8	(3.6)	75	(0.7)	0	(0.0)
Total	47	(21.4)	220	(1.9)	0	(0.0)
PARASITIC						
Trichinella spiralis	1	(0.5)	4	(< 0.1)	0	(0.0)
Total	1	(0.5)	4	(< 0.1)	0	(0.0)
VIRAL						
Hepatitis A	19	(8.5)	325	(2.9)	0	(0.0)
Norwalk virus	2	(0.9)	5,000	(45.2)	0	(0.0)
Total	21	(9.4)	5,325	(48.1)	0	(0.0)
CONFIRMED TOTAL	**220**	**(100.0)**	**11,050**	**(100.0)**	**24**	**(100.0)**

TABLE 2. Foodborne outbreaks by specific etiologic

Etiologic agent	Beef	Ham	Pork	Sausage	Chicken	Turkey	Other meat	Shellfish	Tuna	Mahi-Mahi	Other fish	Milk	Eggs	Ice cream
BACTERIAL														
B. cereus	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Brucella	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C. jejuni	-	-	-	-	-	-	-	-	-	-	-	2	-	-
C. botulinum	1	-	-	-	-	-	-	-	-	-	1	-	-	-
C. perfringens	6	-	-	-	-	4	2	-	-	-	-	-	-	-
E. coli	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Salmonella	1	-	2	1	2	4	1	-	-	-	1	1	2	4
Shigella	-	-	-	-	-	-	-	-	1	-	-	-	-	-
S. aureus	5	3	2	1	4	3	1	-	-	-	-	-	-	-
Streptococcus Group A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. cholerae O1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V. cholerae non-O1	-	-	-	-	-	-	-	1	-	-	-	-	-	-
V. parahaemolyticus	-	-	-	-	-	-	-	3	-	-	-	-	-	-
Y. enterocolitica	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	16	3	4	2	6	11	4	4	1	-	2	4	2	5
CHEMICAL														
Ciguatoxin	-	-	-	-	-	-	-	-	-	-	8	-	-	-
Heavy metals	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monosodium glutamate	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mushrooms	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shellfish	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Scombrotoxin	-	-	-	-	-	-	-	-	3	5	10	-	-	-
Other	1	-	-	1	-	-	-	-	-	-	-	-	-	-
Total	1	-	-	1	-	-	-	1	3	5	18	-	-	-
PARASITIC														
Trichinella spiralis	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	1	-	-	-	-	-	-	-	-	-	-	-
VIRAL														
Hepatitis A	-	-	-	-	-	-	-	5	1	-	-	-	-	1
Norwalk virus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	5	1	-	-	-	-	1
CONFIRMED TOTAL	17	3	5	3	8	11	4	10	5	5	20	4	2	6
UNKNOWN	5	2	1	1	7	-	-	56	2	-	1	-	1	-
TOTAL 1982	22	5	6	4	13	11	4	66	7	5	21	4	3	6

agent and vehicle of transmission, United States, 1982

Baked foods	Fruits & vegetable	Potato salad	Poultry, fish, egg salad	Other salad	Fried rice	Chinese food	Mexican food	Carbonated bev	Non-dairy bev	Multiple foods	Mushrooms	Other foods	Unknown	Total
1	-	-	-	1	3	-	-	-	-	-	-	1	-	8
-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
-	16	-	-	-	-	-	-	-	-	-	1	1	1	21
-	-	-	-	-	-	-	2	-	-	1	-	-	7	22
-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
-	-	-	1	2	-	-	1	-	-	-	-	3	29	55
-	-	-	-	1	-	-	-	-	-	-	-	-	2	4
2	-	2	1	-	-	-	1	-	-	1	-	-	2	28
-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
-	1	-	-	-	-	-	-	-	-	-	-	-	-	2
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	17	2	2	5	3	-	4	-	-	3	1	5	42	151
-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
-	-	-	-	-	-	-	-	4	1	-	-	-	-	5
-	-	-	-	-	-	2	-	-	-	1	-	-	-	3
-	-	-	-	-	-	-	-	-	-	-	4	-	-	4
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	18
-	1	-	-	-	-	-	-	1	1	-	-	3	-	8
-	1	-	-	-	-	2	-	5	2	1	4	3	-	47
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
1	-	-	-	-	-	-	-	-	-	1	-	-	10	19
1	-	-	-	1	-	-	-	-	-	-	-	-	-	2
2	-	-	-	1	-	-	-	-	-	1	-	-	10	21
5	18	2	2	6	3	2	4	5	2	5	5	8	52	220
5	1	3	1	6	1	1	2	-	-	5	1	9	325	436
10	19	5	3	12	4	3	6	5	2	10	6	17	377	656

TABLE 3. Foodborne disease outbreaks, by specific etiologic agent and place where food was eaten, United States, 1982

Etiologic agent	Home	Delicatessen, cafeteria, or restaurant	School	Picnic	Church	Camp	Other	Unknown	Total
BACTERIAL									
B. cereus	-	3	2	-	-	1	2	-	8
Brucella	1	-	-	-	-	-	-	-	1
C. jejuni	1	-	-	-	-	-	1	-	2
C. botulinum	21	-	-	-	-	-	-	-	21
C. perfringens	-	9	1	-	-	-	12	-	22
E. coli	-	-	-	-	-	-	2	-	2
Salmonella	12	17	6	3	4	1	12	-	55
Shigella	1	2	-	-	1	-	-	-	4
S. aureus	4	7	2	2	2	1	10	-	28
Streptococcus Group A	-	-	-	-	-	-	1	-	1
V. cholerae O1	1	-	-	-	-	-	-	-	1
V. cholerae non-O1	1	-	-	-	-	-	-	-	1
V. parahaemolyticus	1	-	-	1	-	-	1	-	3
Y. enterocolitica	1	-	-	-	-	-	1	-	2
Total	44	38	11	6	7	3	42	-	151
CHEMICAL									
Ciguatoxin	3	5	-	-	-	-	-	-	8
Heavy metals	1	3	-	-	-	-	1	-	5
Monosodium glutamate	1	2	-	-	-	-	-	-	3
Mushroom	3	-	-	-	-	-	1	-	4
Shellfish	1	-	-	-	-	-	-	-	1
Scombrotoxin	7	9	-	-	-	-	2	-	18
Other chemical	4	4	-	-	-	-	-	-	8
Total	20	23	-	-	-	-	4	-	47
PARASITIC									
Trichinella spiralis	1	-	-	-	-	-	-	-	1
Total	1	-	-	-	-	-	-	-	1
VIRAL									
Hepatitis A	5	6	-	1	-	1	6	-	19
Norwalk virus	-	1	-	-	-	-	1	-	2
Total	5	7	-	1	-	1	7	-	21
CONFIRMED TOTAL	70	68	11	7	7	4	53	-	220
UNKNOWN	127	221	17	16	2	1	49	3	436
TOTAL 1982	**197**	**289**	**28**	**23**	**9**	**5**	**102**	**3**	**656**

TABLE 4. Foodborne disease outbreaks by specific etiologic agent and month of occurrence, United States, 1982

Etiologic agent	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unknown	Total
BACTERIAL														
Brucella	-	-	1	-	-	-	-	-	-	-	-	-	-	1
B. cereus	2	-	-	-	-	-	2	2	2	-	-	-	-	8
C. jejuni	-	-	-	-	-	1	-	-	1	-	-	-	-	2
C. botulinum	-	3	-	-	2	3	3	2	1	1	3	3	-	21
C. perfringens	-	2	1	1	5	2	1	2	2	1	2	3	-	22
E. coli	-	1	-	-	1	-	-	-	-	-	-	-	-	2
Salmonella	2	1	1	5	4	5	10	11	3	5	3	5	-	55
Shigella	-	-	-	1	-	-	-	-	1	1	1	-	-	4
S. aureus	2	1	1	2	2	3	5	5	1	3	1	2	-	28
Streptococcus Group A	-	-	-	-	-	-	1	-	-	-	-	-	-	1
V. cholerae O1	-	-	-	-	-	-	-	1	-	-	-	-	-	1
V. cholerae non-O1	-	-	-	-	-	-	-	-	-	-	-	1	-	1
V. parahaemolyticus	-	-	-	-	-	-	2	1	-	-	-	-	-	3
Y. enterocolitica	-	1	-	-	-	1	-	-	-	-	-	-	-	2
Total	6	9	4	9	14	15	24	24	11	11	10	14	-	151
CHEMICAL														
Ciguatoxin	1	-	-	-	-	-	3	3	-	-	1	-	-	8
Heavy metals	1	1	-	-	1	-	-	-	-	-	2	-	-	5
Monosodium glutamate	1	-	1	-	-	-	-	1	-	-	-	-	-	3
Mushrooms	-	-	1	-	-	-	2	-	1	-	-	-	-	4
Shellfish	-	-	-	-	-	-	-	1	-	-	-	-	-	1
Scombrotoxin	1	-	-	-	-	1	1	4	6	4	-	1	-	18
Other	-	-	2	2	1	-	-	-	1	1	1	-	-	8
Total	4	1	4	2	2	1	6	9	8	5	4	1	-	47
PARASITIC														
Trichinella spiralis	-	-	-	-	1	-	-	-	-	-	-	-	-	1
Total	-	-	-	-	1	-	-	-	-	-	-	-	-	1
VIRAL														
Hepatitis A	3	-	-	-	2	3	3	4	1	1	-	2	-	19
Norwalk virus	-	-	-	-	-	-	-	1	-	-	1	-	-	2
Total	3	-	-	-	2	3	3	5	1	1	1	2	-	21
CONFIRMED TOTAL	13	10	8	11	19	19	33	38	20	17	15	17	-	220
UNKNOWN	27	31	27	29	43	31	21	32	30	27	26	112	-	436
TOTAL 1982	**40**	**41**	**35**	**40**	**62**	**50**	**54**	**70**	**50**	**44**	**41**	**129**	-	**656**

TABLE 5. Foodborne disease outbreaks by etiologic agent and contributing factors, United States, 1982

Etiologic agent	Number of reported outbreaks	Outbreaks in which factors reported	Improper holding temperatures	Inadequate cooking	Contaminated equipment	Food from unsafe source	Poor personal hygiene	Other
BACTERIAL								
B. cereus	8	5	5	-	-	-	1	-
Brucella	1	-	-	-	-	-	-	-
C. jejuni	2	2	-	-	-	1	-	1
C. botulinum	21	4	1	-	-	-	-	3
C. perfringens	22	20	19	8	3	-	-	2
E. coli	2	1	1	-	-	-	-	-
Salmonella	55	34	16	18	6	6	7	4
Shigella	4	4	1	-	-	-	4	-
S. aureus	26	21	20	3	4	1	9	1
Streptococcus Group A	1	1	1	-	-	-	1	-
Streptococcus Group D	1	-	-	-	-	-	-	-
V. cholerae O1	1	-	-	-	-	-	-	-
V. cholerae non-O1	1	1	-	1	-	-	-	-
V. parahaemolyticus	3	2	-	-	-	2	-	-
Y. enterocolitica	2	-	-	-	-	-	-	-
Total	151	95	64	30	13	10	22	11
CHEMICAL								
Ciguatoxin	8	1	-	-	-	1	-	-
Heavy metals	5	4	-	-	2	-	1	2
Monosodium glutamate	3	2	-	-	-	-	-	2
Mushrooms	4	2	-	-	-	2	-	-
Shellfish	1	1	-	-	-	1	-	-
Scombrotoxin	18	9	5	-	-	5	-	-
Other	8	6	-	-	3	-	-	3
Total	47	25	5	-	5	9	1	7
PARASITIC								
Trichinella spiralis	1	1	-	1	-	1	-	-
Total	1	1	-	1	-	1	-	-
VIRAL								
Hepatitis A	19	14	2	2	-	6	8	3
Norwalk virus	2	2	-	-	-	-	2	-
Total	21	16	2	2	-	6	11	3
CONFIRMED TOTAL	220	137	71	33	18	26	34	21
UNKNOWN	436	225	87	73	35	94	59	16
TOTAL 1982	**656**	**362**	**158**	**106**	**53**	**120**	**93**	**37**

Nosocomial Infection Surveillance, 1984

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Introduction

Nosocomial infections cause substantial morbidity and mortality, prolong the hospital stay of affected patients, and increase direct patient-care costs (*1-5*). Since 1970, the National Nosocomial Infections Surveillance System (NNIS) has collected and analyzed data on the frequency of nosocomial infections in U.S. hospitals. This report provides descriptive data on nosocomial infections in a sample of U.S. hospitals in 1984.

Materials and Methods

The methods used in this surveillance system and the characteristics of participating hospitals have been described in detail (*4,6*). In brief, hospitals participating in NNIS conduct active hospital-wide surveillance using uniform definitions of nosocomial infections. Although the definitions are specific for different sites of infection, onset must occur during hospitalization or shortly after discharge, and the infection may not be present or incubating at the time of the patient's admission. Each month data are recorded on standardized forms that are sent to CDC, where they are coded, edited, and entered into a computer before being analyzed. In 1984, 51 hospitals regularly ($\geq$ 9 months) reported data to CDC. For each nosocomial infection detected, the following information was reported: site of infection; date of onset; hospital service on which the patient was placed; age and sex of the patient; pathogens isolated; occurrence of secondary bacteremia; antimicrobial susceptibility of bacterial pathogens; and, for those patients who died with a nosocomial infection, the relationship of the infection to death. In addition, the hospitals reported the number of patients discharged each month from six primary services: medicine, surgery, obstetrics, gynecology, pediatrics, and newborn.

Results

The NNIS Sample. The hospitals participating in NNIS are not a probability sample of U.S. hospitals; however, those hospitals that regularly reported data in 1984 ranged in size from 80 to 1,200 beds, were located throughout the United States, and were owned by state and local governments, as well as by profit and nonprofit organizations. The geographic distribution of the 51 hospitals among the four regions of the country (Northeast, North Central, South, and West) was roughly the same as that for all 6,375 U.S. acute-care hospitals included in the American Hospital Association Annual Survey of Hospitals (*7*). Hospitals affiliated with medical schools, referred to as teaching hospitals, are still greatly overrepresented among the NNIS hospitals; 61% (31/51) of the NNIS hospitals are teaching hospitals, where-

as only 17% of the hospitals across the country are affiliated with a medical school. Similarly, the 51 NNIS hospitals tend to be large, with a median size of 406 beds, compared with a median size of only 112 beds for the 6,375 U.S. acute-care hospitals (*7*).

Despite these limitations, previous analyses have shown that data collected in NNIS can be usefully interpreted by stratifying the 51 reporting hospitals into three groups: 1) 20 (39%) nonteaching hospitals, 2) 18 (35%) small teaching hospitals of 500 or fewer beds, and 3) 13 (26%) large teaching hospitals of more than 500 beds (*4,6*).

The overall infection rate (number of hospital-acquired infections per 1,000 patients discharged) was highest in the large teaching hospitals and lowest in the nonteaching hospitals (Table 1). In all three hospital categories, the infection rate was highest on the surgery service, followed by the medicine and gynecology services (Table 2). On each of the six primary services, the infection rate was highest at the large teaching hospitals and lowest at the nonteaching hospitals, with the exception of the gynecology service rate, which was highest at small teaching hospitals.

In all three hospital categories, the urinary tract was the site most frequently infected, followed by lower respiratory tract or surgical wound infections (Table 3). For each site of infection, the infection rates were highest in the large teaching hospitals and lowest in the nonteaching hospitals.

Infections of the urinary tract, of surgical wounds, and of the lower respiratory tract accounted for almost three-fourths of the infections in all three hospital categories (Table 4). Primary bacteremia and cutaneous infections accounted for a higher percentage of infections in the large teaching hospitals than in the other hospitals.

Combined Rates by Service and Site. In general, the site-specific infection rate on each service was highest in the large teaching hospitals and lowest in the nonteaching hospitals

TABLE 1. Infection rates (cases/1,000 discharges), by hospital category, 1984

Hospital category	Infections	Discharges	Rate
Nonteaching	4,960	223,909	22.2
Small teaching	9,031	267,078	33.8
Large teaching	12,974	313,697	41.4
Total	**26,965**	**804,684**	**33.5**

TABLE 2. Infection rates (cases/1,000 discharges), by hospital category and service, 1984

	Service*					
Hospital category	SURG	MED	GYN	OB	NEW	PED
Nonteaching	30.8	23.3	8.6	5.6	8.6	1.2
Small teaching	47.3	38.1	35.2	14.9	14.7	14.6
Large teaching	59.3	46.9	31.7	20.3	17.3	16.6
Total	**46.7**	**36.5**	**28.1**	**15.3**	**14.4**	**13.3**

*SURG = surgery, MED = medicine, GYN = gynecology, OB = obstetrics, NEW = newborn, PED = pediatrics

(Table 5). In each hospital category, urinary tract infections occurred predominantly on the medicine, surgery, and gynecology services. Surgical wound infections occurred primarily on the surgery, gynecology, and obstetrics services. Lower respiratory infections occurred predominantly on the surgery and medicine services. Primary bacteremia occurred most frequently on the medicine and surgery services at nonteaching and large teaching hospitals. At small teaching hospitals, primary bacteremia was most frequently seen on the medicine and pediatrics services, followed by the newborn and surgery services. Cutaneous infections occurred primarily on the newborn service in each hospital category.

Pathogens. Of the 26,965 infections reported, 64% were caused by single pathogens, and 20% were caused by multiple pathogens (Figure 1). No pathogen was identified in 6% of the infections, and no culture was obtained in 10%. Of the 84% of infections in which a pathogen was identified, 86% were caused by aerobic bacteria, 2% by anaerobic bacteria, and 8% by fungi. Viruses, protozoa, and parasites collectively accounted for 5% of the infections of known etiology.

Escherichia coli, Pseudomonas aeruginosa, enterococci, and *Staphylococcus aureus* were the most frequently reported pathogens (Table 6). *E. coli* was the pathogen most often reported on all services except pediatrics and newborn, where *S. aureus* was the most common. *P. aeruginosa* was the second most frequently identified pathogen on the medicine and surgery services, whereas enterococci were second on the gynecology and obstetrics services. Coagulase-negative staphylococci were the second most frequently identified pathogens on the pediatrics and newborn services.

TABLE 3. Infection rates (cases/1,000 discharges), by hospital category and site of infection, 1984

	Site*					
Hospital category	**UTI**	**SWI**	**LRI**	**BACT**	**CUT**	**Other**
Nonteaching	9.9	3.6	4.2	1.3	1.1	2.0
Small teaching	13.9	6.0	5.4	1.9	1.8	4.7
Large teaching	14.2	6.6	7.7	3.9	2.6	6.4
Total	**12.9**	**5.6**	**6.0**	**2.5**	**1.9**	**4.6**

*UTI = urinary tract infection, SWI = surgical wound infection, LRI = lower respiratory infection, BACT = primary bacteremia, CUT = cutaneous infection

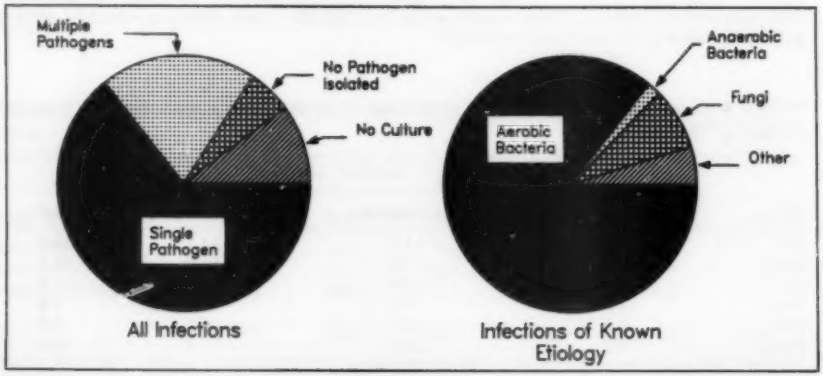
TABLE 4. Percentage distribution of infections at each of the major sites, by hospital category, 1984

	Hospital category			
Site	**Nonteaching**	**Small teaching**	**Large teaching**	**Total**
UTI	44.6	41.2	34.2	**38.5**
SWI	16.0	17.8	16.0	**16.6**
LRI	19.2	15.9	18.6	**17.8**
BACT	6.0	5.7	9.4	**7.5**
CUT	4.9	5.4	6.3	**5.8**
Other	9.3	14.0	15.4	**13.8**

TABLE 5. Site-specific infection rates (cases/1,000 discharges), by service, 1984

Service	Site						
	UTI	SWI	LRI	BACT	CUT	Other	All sites
1. Nonteaching hospitals							
SURG	12.1	8.5	5.4	1.3	1.4	2.0	30.8
MED	12.6	0.4	5.2	1.9	0.8	2.3	23.3
GYN	5.8	1.6	0.1	0.1	0.1	0.8	8.6
OB	1.1	2.4	0.1	0.1	0.5	1.4	5.6
PED	0.0	0.1	0.1	0.0	0.1	0.9	1.2
NEW	0.5	0.2	1.8	0.6	2.6	2.9	8.6
Total	**9.9**	**3.6**	**4.2**	**1.3**	**1.1**	**2.0**	**22.2**
2. Small teaching hospitals							
SURG	17.7	13.6	7.8	1.8	1.6	4.7	47.3
MED	20.1	0.6	7.5	2.8	1.7	5.3	38.1
GYN	19.9	11.1	1.3	0.4	0.2	2.2	35.2
OB	3.8	6.8	0.3	0.2	0.5	3.4	14.9
PED	2.0	0.6	2.0	2.4	2.3	5.2	14.6
NEW	0.6	0.2	1.4	2.0	4.8	5.6	14.7
Total	**13.9**	**6.0**	**5.4**	**1.9**	**1.8**	**4.7**	**33.8**
3. Large teaching hospitals							
SURG	19.5	15.0	11.2	4.2	3.3	6.1	59.3
MED	19.5	1.2	10.2	5.7	3.0	7.3	46.9
GYN	14.4	10.2	2.6	0.9	0.6	3.1	31.7
OB	4.2	6.6	0.5	0.9	0.5	7.5	20.3
PED	2.8	1.6	3.9	2.1	1.2	4.9	16.6
NEW	1.0	0.3	2.9	3.6	3.7	5.6	17.4
Total	**14.2**	**6.6**	**7.7**	**3.9**	**2.6**	**6.4**	**41.4**

FIGURE 1. Distribution of infections, by etiology, 1984



E. coli was the pathogen most frequently associated with urinary tract infections, followed by enterococci and *P. aeruginosa* (Table 7). *S. aureus* was the pathogen most often associated with surgical wound infections, followed by enterococci and *E. coli*. *P. aeruginosa* was the pathogen most frequently associated with lower respiratory tract infections, followed by *S. aureus* and *Klebsiella* spp. Coagulase-negative staphylococci were the pathogens most commonly associated with primary bacteremia, followed by *S. aureus* and *E. coli*.

When the pathogens causing infections at the five major sites were examined by service, interesting differences were noted (Table 8). On all six services, *E. coli* was the pathogen most often isolated from the urinary tract. Enterococci were the second most frequently isolated pathogens from the urinary tract on the obstetrics, gynecology, and medicine services, whereas *P. aeruginosa* was the second most commonly isolated pathogen from the urinary tract on the surgery and pediatrics services, and *Klebsiella* spp. were second on the newborn service. *S. aureus* was the pathogen most often associated with surgical wound infections on all services except gynecology, where *E. coli* was isolated most frequently. The pathogen most frequently associated with lower respiratory infections on all services was *P. aeruginosa*, with *S. aureus* second on all but the gynecology and newborn services. Coagulase-negative staphylococci were most often associated with primary bacteremia on the pediatrics, newborn, and surgery services, whereas *S. aureus* was the pathogen most frequently associated with bacteremia on the medicine and obstetrics services. *E. coli* and *Bacteroides* spp. were isolated with the highest frequency in association with primary bactere-

TABLE 6. The 15 most frequently isolated pathogens and their percentage distribution on each service, 1984

	Service							
Pathogen	MED	SURG	OB	GYN	PED	NEW	Total isolates	%
E. coli	19.6	16.2	21.2	29.8	11.4	9.3	5,266	17.8
P. aeruginosa	11.4	13.0	1.3	4.3	9.7	6.7	3,366	11.4
Enterococci	9.6	10.5	16.6	18.1	5.3	5.7	3,063	10.4
S. aureus	9.2	10.4	8.0	5.8	16.6	24.8	3,059	10.3
Klebsiella spp.	9.0	6.9	2.1	4.8	6.6	6.7	2,193	7.4
Coagulase-negative staphylococci	5.6	6.1	5.7	5.2	13.2	15.3	1,868	6.3
Enterobacter spp.	4.7	7.5	2.1	3.7	4.2	3.7	1,748	5.9
Candida spp.	7.0	4.9	1.1	2.2	7.6	3.8	1,620	5.5
Proteus spp.	5.6	5.4	3.4	5.3	0.3	1.0	1,522	5.1
Serratia spp.	2.1	2.9	0.2	0.3	1.4	1.3	691	2.3
Other fungi	2.3	1.5	0.1	0.1	1.2	1.0	496	1.7
Citrobacter spp.	1.5	1.5	1.1	0.8	1.0	0.8	414	1.4
Bacteroides spp.	0.6	1.4	4.6	2.8	0.3	0.2	355	1.2
Group B *Streptococcus*	0.8	0.5	7.9	3.8	1.2	6.2	348	1.2
Other anaerobes	0.9	0.9	4.8	2.0	0.3	0.2	300	1.0
All others*	10.1	10.4	19.8	11.0	19.7	13.3	3,253	11.1
Number of Isolates	11,304	14,596	1,024	1,016	590	1,032	29,562	100.0

*No other pathogen accounted for more than 3% of the isolates on any service.

mia on the gynecology service. *S. aureus* was most commonly associated with cutaneous infections and was followed by coagulase-negative staphylococci on all services except surgery and obstetrics. On surgery, *S. aureus* was first, followed by *P. aeruginosa*; on obstetrics, *E. coli* was isolated most frequently, followed by *S. aureus*.

Secondary Bacteremia. Secondary bacteremia was defined as a bloodstream infection with an organism that was also isolated from an infection at another site. Secondary bacteremia was reported most frequently by large teaching hospitals and least frequently by nonteaching hospitals (Table 9). Secondary bacteremia occurred most often on the pediatrics service in teaching hospitals, followed by the medicine, newborn, and surgery services, and it occurred least frequently on the obstetrics and gynecology services. In nonteaching hospitals, secondary bacteremia occurred most often on the medicine, obstetrics, and surgery services and least often on the newborn, gynecology, and pediatrics services. For all hospital categories, secondary bacteremia was associated less frequently with urinary tract, surgical wound, lower respiratory tract, and cutaneous infections than with infections, collectively, at "other" sites (Table 10). With respect to the four major sites, and excluding primary bacteremia, secondary bacteremia occurred most often following cutaneous infections. It occurred most frequently in all hospitals following infections with *Acinetobacter* spp., *Bacteroides* spp., *S. aureus*, *Serratia* spp., and coagulase-negative staphylococci (Table 11), but this varied greatly within each hospital category. For example, in nonteaching hospitals, *S. aureus* was the main pathogen that caused secondary bacteremia. In small teaching hospitals, the frequency of secondary bacteremia due to coagulase-negative staphylococci has nearly doubled

TABLE 7. The 15 most frequently isolated pathogens and their percentage distribution for each site of infection, 1984

	Site							
Pathogen	UTI	SWI	LRI	BACT	CUT	Other	Total isolates	%
E. coli	30.7	11.5	6.4	10.1	7.0	7.4	5,266	17.8
P. aeruginosa	12.7	8.9	16.9	7.6	9.2	6.7	3,366	11.4
Enterococci	14.7	12.1	1.5	7.1	8.8	7.0	3,063	10.4
S. aureus	1.6	18.6	12.9	12.3	28.9	14.6	3,059	10.3
Klebsiella spp.	8.0	5.2	11.6	7.8	3.8	4.6	2,193	7.4
Coagulase-negative staphylococci	3.4	8.3	1.5	14.9	11.5	11.6	1,868	6.3
Enterobacter spp.	4.8	7.0	9.4	6.3	4.5	3.9	1,748	5.9
Candida spp.	5.4	1.7	4.0	5.6	5.8	14.1	1,620	5.5
Proteus spp.	7.4	5.2	4.2	0.8	3.3	2.1	1,522	5.1
Serratia spp.	1.2	2.1	5.8	3.0	2.2	1.5	691	2.3
Other fungi	2.2	0.4	1.4	1.3	0.9	2.8	496	1.7
Citrobacter spp.	1.8	1.4	1.4	0.7	0.7	0.9	414	1.4
Bacteroides spp.	0.0	3.7	0.2	3.4	1.2	1.4	355	1.2
Group B *Streptococcus*	0.9	1.3	0.7	2.3	1.1	1.9	348	1.2
Other anaerobes	0.0	1.7	0.1	1.8	0.8	4.4	300	1.0
All others*	5.2	10.9	22.0	15.0	10.3	15.1	3,253	11.1
Number of isolates	12,218	5,500	4,567	2,264	1,690	3,323	29,562	100.0

*No other pathogen accounted for more than 3% of the isolates at any site.

TABLE 8. Five most common pathogens isolated and percentage o

	UTI		SWI		
Service	**Pathogen**	**%**	**Pathogen**	**%**	**Patho**
Medicine	*E. coli*	30.6	*S. aureus*	19.7	*P. ae*
	Enterococci	14.2	Enterococci	12.1	*S. au*
	P. aeruginosa	11.3	*P. aeruginosa*	9.3	*Klebs*
	Klebsiella spp.	9.4	Coag-neg *staph.*	9.0	*Enter*
	Proteus spp.	8.1	*E. coli*	6.9	*E. col*
Surgery	*E. coli*	29.2	*S. aureus*	19.0	*P. ae*
	P. aeruginosa	16.1	Enterococci	12.1	*S. au*
	Enterococci	13.4	*E. coli*	11.5	*Enter*
	Proteus spp.	7.4	*P. aeruginosa*	9.7	*Klebs*
	Klebsiella spp.	6.7	Coag-neg *staph.*	7.9	*Serra*
Gynecology	*E. coli*	40.7	*E. coli*	15.1	*P. ae*
	Enterococci	23.5	*S. aureus*	12.9	*Enter*
	Klebsiella spp.	6.7	Enterococci	12.9	*S. au*
	Proteus spp.	5.0	Coag-neg *staph.*	11.5	*Cand*
	P. aeruginosa	4.5	*Bacteroides* spp.	6.8	*Klebs*
Obstetrics	*E. coli*	36.3	*S. aureus*	13.7	*P. ae*
	Enterococci	28.8	*E. coli*	13.7	*S. au*
	Group B *strep.*	6.0	Enterococci	12.5	*Klebs*
	Coag-neg *staph.*	3.6	Coag-neg *staph.*	9.6	*E. co*
	Proteus spp.	3.3	*Bacteroides* spp.	8.3	*Cand*
Pediatrics	*E. coli*	30.4	*S. aureus*	34.8	*P. ae*
	P. aeruginosa	13.4	*E. coli*	10.6	*S. au*
	Enterococci	10.7	*P. aeruginosa*	10.6	*Klebs*
	Klebsiella spp.	10.7	Coag-neg *staph.*	10.6	*Enter*
	Candida spp.	10.7	Enterococci	7.6	*Cand*
Newborn	*E. coli*	35.2	*S. aureus*	23.1	*P. ae*
	Klebsiella spp.	15.5	Coag-neg *staph.*	23.1	*Klebs*
	Coag-neg *staph.*	9.9	*P. aeruginosa*	15.4	*Coag*
	Enterococci	8.5	Enterococci	7.7	*E. co*
	Candida spp.	8.5	*Klebsiella* spp.	7.7	*S. au*

tage of total within each site and service, 1984

Site					
LRI		BACT		CUT	
Pathogen	%	Pathogen	%	Pathogen	%
P. aeruginosa	16.6	*S. aureus*	14.4	*S. aureus*	26.3
S. aureus	14.8	Coag-neg *staph.*	13.8	Coag-neg *staph.*	11.8
Klebsiella spp.	12.2	*E. coli*	12.2	*P. aeruginosa*	11.0
Enterobacter spp.	7.7	*P. aeruginosa*	9.2	Enterococci	9.1
E. coli	7.3	*Klebsiella* spp.	8.5	*Candida* spp.	6.6
P. aeruginosa	16.5	Coag-neg *staph.*	14.0	*S. aureus*	19.0
S. aureus	11.5	*S. aureus*	10.2	*P. aeruginosa*	12.9
Enterobacter spp.	11.4	*Enterobacter* spp.	9.2	Enterococci	10.7
Klebsiella spp.	11.2	Enterococci	9.1	Coag-neg *staph.*	10.1
Serratia spp.	6.9	*Klebsiella* spp.	7.5	*E. coli*	7.9
P. aeruginosa	15.6	*E. coli*	16.0	*S. aureus*	18.8
Enterobacter spp.	9.4	*Bacteroides* spp.	16.0	Coag-neg *staph.*	12.5
S. aureus	6.3	Coag-neg *staph.*	8.0	*Morganella* spp.	12.5
Candida spp.	6.3	*S. aureus*	8.0	Viruses	12.5
Klebsiella spp.	3.1	*Klebsiella* spp.	4.0	Other anaerobes	12.5
P. aeruginosa	7.7	*S. aureus*	14.3	*E. coli*	25.6
S. aureus	7.7	Other anaerobes	12.2	*S. aureus*	23.1
Klebsiella spp.	7.7	*E. coli*	8.2	Enterococci	10.3
E. coli	7.7	Coag-neg *staph.*	6.1	Coag-neg *staph.*	7.7
Candida spp.	7.7	Enterococci	6.1	Group B. *strep.*	5.1
P. aeruginosa	19.8	Coag-neg *staph.*	29.0	*S. aureus*	40.3
S. aureus	11.6	*S. aureus*	14.0	Coag-neg *staph.*	19.4
Klebsiella spp.	9.3	*E. coli*	10.8	*E. coli*	10.4
Enterobacter spp.	7.0	*Klebsiella* spp.	6.5	*Candida* spp.	7.5
Candida spp.	3 5	*Candida* spp.	6.5	Enterococci	4.5
P. aeruginosa	29.5	Coag-neg *staph.*	20.8	*S. aureus*	54.5
Klebsiella spp.	15.2	Group B. *strep.*	15.3	Coag-neg *staph.*	12.6
Coag-neg *staph.*	9.8	Enterococci	9.9	*E. coli*	6.1
E. coli	8.0	*E. coli*	9.4	Enterococci	4.8
S. aureus	7.1	*Klebsiella* spp.	8.4	*Enterobacter* spp.	4.2

since 1983 (*6*). In addition, *Bacteroides* spp., *S. aureus*, Group B *Streptococcus*, and *Acinetobacter* were frequently associated with secondary bacteremia in small teaching hospitals. In large teaching hospitals, no pathogen predominated as the causative agent of secondary bacteremia.

TABLE 9. Percentage of infections* with secondary bacteremia, by service and hospital category, 1984

	Service						
Hospital category	**SURG**	**MED**	**GYN**	**OB**	**NEW**	**PED**	**All services**
Nonteaching	3.6	4.3	1.6	4.0	2.9	0.0	3.8
Small teaching	5.0	5.5	1.8	3.1	5.2	6.8	4.9
Large teaching	6.5	8.5	1.8	2.5	6.5	8.6	6.8
All hospitals	**5.4**	**6.6**	**1.8**	**2.8**	**5.5**	**7.8**	**5.6**

*Excluding primary bacteremia

TABLE 10. Percentage of infection with secondary bacteremia, by site* and hospital category, 1984

	Site					
Hospital category	**UTI**	**SWI**	**LRI**	**CUT**	**Other†**	**All sites**
Nonteaching	3.1	3.5	3.3	4.1	8.9	3.8
Small teaching	2.7	4.2	6.1	9.4	9.6	4.9
Large teaching	3.9	6.0	5.9	9.4	14.3	6.8
All hospitals	**3.3**	**4.9**	**5.4**	**8.6**	**12.0**	**5.6**

*Excluding primary bacteremia.

†Most frequently associated with cardiovascular (70.8%) and intra-abdominal infections (10.5%).

TABLE 11. Ten pathogens with the highest percentage of associated secondary bacteremia, by hospital category, 1984

	Nonteaching		Small teaching		Large teaching		All hospitals	
Pathogen	**No. of infections**	**% with secondary bacteremia**	**No. of infections**	**% with secondary bacteremia**	**No. of infections**	**% with secondary bacteremia**	**No. of infections**	**% with secondary bacteremia**
Acinetobacter spp.	21	0.0	30	10.0	85	22.4	136	16.2
Bacteroides spp.	17	5.9	51	13.7	47	19.1	115	14.8
S. aureus	439	9.3	887	12.4	1,118	15.9	2,444	13.5
Serratia spp.	99	6.1	118	5.9	239	18.0	456	12.3
Coagulase-negative staphylococci	151	3.3	449	11.1	529	13.4	1,129	11.2
Group B *Streptococcus*	35	2.9	87	10.3	79	10.1	201	9.0
Klebsiella spp.	290	4.8	475	4.6	667	10.6	1,432	7.5
Other fungi	34	5.9	139	2.9	180	10.0	353	6.8
Morganella spp.	36	5.6	45	4.4	53	7.5	134	6.0
Other *Pseudomonas* spp.	63	0.0	66	3.0	89	12.4	218	6.0

Antimicrobial Resistance. Resistance was defined as the number of resistant isolates divided by the number of organisms that were either sensitive or resistant, multiplied by 100. Methicillin-resistant *S. aureus* was most commonly reported from the large teaching hospitals (Table 12). In fact, for all the antimicrobials listed in Table 12, resistance was most often reported from the large teaching hospitals.

The percentages of *E. coli, Klebsiella pneumoniae, Serratia marcescens,* and *P. aeruginosa* organisms that were resistant to aminoglycosides and selected beta-lactam antibiotics varied according to the three hospital categories (Tables 13-16). Aminoglycoside resistance was most common in *P. aeruginosa* and *S. marcescens,* and cefotaxime or moxalactam resistance was most common in *P. aeruginosa.*

TABLE 12. Antimicrobial resistance of *Staphylococcus aureus*, 1984

Hospital category	Number resistant (%)									
	Methicillin		Gentamicin		Clindamycin		Chloramphenicol		Erythromycin	
Nonteaching	23	(6.0)	38	(8.6)	41	(9.1)	19	(5.4)	58	(11.9)
Small teaching	43	(4.6)	50	(5.9)	65	(7.2)	25	(3.0)	107	(10.9)
Large teaching	140	(11.3)	106	(10.6)	140	(10.4)	84	(7.2)	245	(18.0)

TABLE 13. Antimicrobial resistance of *Escherichia coli*, 1984

Hospital category	Number resistant (%)									
	Gentamicin		Tobramycin		Amikacin		Cefotaxime		Moxalactam	
Nonteaching	28	(2.4)	11	(1.4)	9	(1.6)	1	(1.2)	0	(0.0)
Small teaching	48	(2.6)	19	(1.5)	11	(2.2)	6	(3.2)	9	(7.1)
Large teaching	46	(2.0)	51	(2.6)	21	(1.7)	9	(1.3)	3	(1.0)

TABLE 14. Antimicrobial resistance of *Klebsiella pneumoniae*, 1984

Hospital category	Number resistant (%)									
	Gentamicin		Tobramycin		Amikacin		Cefotaxime		Moxalactam	
Nonteaching	20	(4.7)	12	(3.7)	0	(0.0)	0	(0.0)	0	(0.0)
Small teaching	26	(3.6)	12	(2.3)	7	(2.7)	6	(8.6)	5	(8.2)
Large teaching	67	(6.7)	47	(5.9)	24	(4.2)	5	(1.3)	7	(3.1)

TABLE 15. Antimicrobial resistance of *Serratia marcescens*, 1984

Hospital category	Number resistant (%)									
	Gentamicin		Tobramycin		Amikacin		Cefotaxime		Moxalactam	
Nonteaching	10	(6.1)	11	(8.3)	6	(5.4)	3	(7.3)	0	(0.0)
Small teaching	13	(7.2)	16	(11.0)	3	(3.7)	4	(6.1)	6	(10.3)
Large teaching	41	(11.6)	52	(18.4)	18	(8.7)	21	(11.3)	8	(7.2)

Mortality. Data from individual hospitals are included in the mortality analyses if the hospital assessed and reported the relationship of infection to death for more than 50% of the infections in patients who died while hospitalized. The 42 hospitals that met this criterion reported a total of 22,432 infections; among the 1,253 patients who died, there were 1,811 infections for which the relationship of the infection to death was recorded. Approximately 1% of all nosocomial infections caused death, and 3% contributed to death (Table 17). Infections were more often reported to cause or contribute to death in small teaching and in nonteaching hospitals than in large teaching hospitals. Among infected patients who died while hospitalized, 9% of the infections reportedly caused death, 38% contributed to it, and 37% were not related to death; in 15% of these infections, the relationship of the infection to death could not be determined (Table 18).

TABLE 16. Antimicrobial resistance of *Pseudomonas aeruginosa*, 1984

Hospital category	Number resistant (%)									
	Gentamicin		Tobramycin		Amikacin		Cefotaxime		Moxalactam	
Nonteaching	111	(15.1)	43	(6.8)	23	(5.1)	74	(64.3)	30	(30.6)
Small teaching	91	(9.0)	40	(5.0)	33	(6.7)	163	(59.1)	137	(59.1)
Large teaching	228	(15.7)	117	(7.9)	54	(5.6)	180	(36.1)	121	(28.4)

TABLE 17. Percentage of infections reported as having caused or contributed to death of the patient, 1984

Hospital category	Number of infections	Percentage that caused death	Percentage that contributed to death
Nonteaching	3,553	0.7	3.9
Small teaching	8,609	1.1	3.1
Large teaching	10,270	0.5	2.8
Total	**22,432**	**0.7**	**3.1**

TABLE 18. Relationship of infection to death by hospital category, 1984*

Hospital category	Number (%)									
	Caused death		Contributed to death		Not related to death		Unknown		Total	
Nonteaching	23	(6.7)	139	(40.6)	138	(40.4)	42	(12.3)	342	(100)
Small teaching	96	(12.5)	268	(35.0)	251	(32.8)	151	(19.7)	766	(100)
Large teaching	47	(6.7)	287	(40.8)	288	(41.0)	81	(11.5)	703	(100)
Total	**166**	**(9.2)**	**694**	**(38.3)**	**677**	**(37.4)**	**274**	**(15.1)**	**1,811**	**(100)**

*There were 1,811 infections in 1,253 patients who died.

Discussion

Nosocomial infections remain an important cause of morbidity and mortality in U.S. hospitals. Data from NNIS, the only national source of prospectively collected data on hospital-acquired infections, show that the overall rate of nosocomial infections during 1984 was 3.4 infections per 100 patients discharged. This is similar to the infection rate reported for the 3-year period 1980-1982 (*4*) and for 1983 (*6*). By comparison, the Study on the Efficacy of Nosocomial Infection Control (SENIC) found that a nosocomial infection develops in 5%-6% of hospitalized patients (*8*). SENIC was a retrospective study involving a representative sample of U.S. hospitals in 1975-1976. NNIS data suggest that the true incidence of nosocomial infections is underestimated. Factors contributing to the underestimation include variability of the intensity of surveillance and availability of laboratory support, especially in diagnostic virology. Since identification of nosocomial viral infections depends on both laboratory detection and surveillance intensity, hospitals without virology laboratory support will be unlikely to detect most of these infections.

Since 1980 (*4*), nosocomial infection rates have been consistently highest in large teaching hospitals and lowest in nonteaching hospitals for all services and sites of infection, suggesting that the three-level stratification effectively defines hospital categories in which patients have different levels of risk for acquiring nosocomial infections. This difference in risk undoubtedly reflects severity of underlying illness (patient mix) and the extent to which invasive diagnostic and therapeutic procedures are performed in these hospitals.

As in 1980-1982 (*4*) and in 1983 (*6*), the infection rates were highest on the surgery and medicine services, probably because of their high-risk patient populations. The lowest infection rates were on the pediatrics and newborn services. One explanation for this lower rate may be that in NNIS hospitals, there are fewer high-risk children and newborns than adults, particularly in the small hospitals. Furthermore, most of the infants included in the newborn service are in well-baby nurseries, where the infection risk is expected to be lower. Another factor that may help explain the lower rates of infection on the pediatrics and newborn services is that only a small proportion of NNIS hospitals have diagnostic virology laboratories; therefore, many viral infections probably go undetected. Since children more often acquire nosocomial viral infections than adults (*9*), and since in one study viruses accounted for approximately 14% of nosocomial infections in children (*10*), NNIS hospitals are probably underreporting viral infections. In addition, other factors, such as the short time that many pediatric patients are hospitalized and the frequent use of isolation precautions on the pediatrics and newborn services, may reduce the incidence of nosocomial infections on these services.

In 1984, infection rates on different services and at different sites of infection within the three hospital categories varied little from those reported for 1983 (*6*). Since 1980-1982 (*4*), the primary bacteremia and lower respiratory tract infection rates have increased. The overall lower respiratory tract infection rate surpassed the rate of surgical wound infections in 1984. Whether this is an artifact of reporting or a true shift in the rates is not known.

Specimens for microbiologic testing were obtained from 90% of the patients reported to have a nosocomial infection. Aerobic bacteria were the most commonly identified etiologic agents. Anaerobic bacteria, fungi, parasites, and viruses were seldom reported, reflecting in part the frequency with which these pathogens are looked for, as well as the diagnostic laboratory capabilities of the hospitals.

E. coli was the most frequently identified pathogen on the four adult services, reflecting the fact that this organism was the primary cause of urinary tract infections on these services.

In contrast, *S. aureus* was the pathogen most often identified on the newborn and pediatrics services. Coagulase-negative staphylococci were the second most frequent cause of nosocomial infections on the newborn and pediatrics services and were an important cause of bacteremia on all services except gynecology and obstetrics. Recent studies suggest that the increasing use of long-line catheters may be contributing to the emergence of coagulase-negative staphylococci as an important cause of primary bacteremia (*11,12*).

Previous analyses of NNIS data have suggested that secondary bacteremia carries an increased risk of death (*13*). In all hospitals, the major sites of infection that were most likely to result in secondary bacteremia were cutaneous infections, followed by surgical wound and lower respiratory tract infections. Infections at sites other than the four major sites were, collectively, more frequently associated with secondary bacteremia. These include cardiovascular and intra-abdominal infections. An increase in cardiovascular surgery and in the use of long-line venous and arterial catheters may have accounted for the rise since 1983 in the percentage of infections associated with the cardiovascular system (*6*). Because of the increased risk of death associated with secondary bacteremia, these infections continue to be a high priority for prevention and control (*13*).

As in the past, the incidence of methicillin-resistant *S. aureus* (MRSA) infections was highest at large teaching hospitals (*4,6,14*), and between 1983 and 1984, these infections increased by more than 25% in each hospital category (*6*). Since 1983, the proportion of *S. aureus* organisms resistant to gentamicin and clindamycin increased at small teaching and at nonteaching hospitals, but at large teaching hospitals the proportion resistant to gentamicin decreased and that resistant to clindamycin remained about the same (*6*). The factors responsible for these resistance trends require further study. Recent work suggests that risk factors for MRSA may differ by type of hospital (*15*).

In 1984, compared with 1983, the proportion of *K. pneumoniae* organisms resistant to gentamicin and tobramycin decreased in large teaching hospitals and increased in nonteaching hospitals; however, resistance to amikacin increased in large teaching hospitals and decreased in both nonteaching and small teaching hospitals (*6*). Since 1982, the resistance of *P. aeruginosa* to both cefotaxime and moxalactam has increased in the small teaching hospitals, but the trend has been variable in nonteaching hospitals (*4,6*). Over the same period cefotaxime resistance has continued to decrease, and moxalactam resistance has been rising in the large teaching hospitals (*4,6*). Since the proportion of isolates tested against cefotaxime and moxalactam was small, these data should be interpreted with caution.

When compared with NNIS mortality data for 1980-1982 (*4*) and 1983 (*6*), the overall percentage of infections reported to cause or contribute to death in 1984 has not changed significantly. Since 1980, the large teaching hospitals have reported a slightly lower percentage of infections each year as causing or contributing to a patient's death (*4,6*). The small teaching hospitals reported about the same frequency, and the nonteaching hospitals reported a slight increase each year (*4,6*). Mortality data should be interpreted with caution, since standard criteria for assessing the relationship of infection to death do not exist.

This nationwide nosocomial surveillance system is expanding in four directions (*6*). First, microcomputer software called the Interactive Data Entry and Analysis System (IDEAS) has been developed to support nosocomial infection surveillance activities of NNIS hospitals. Beginning in October 1984, IDEAS was pilot tested in three hospitals and is now being used in 22 additional hospitals. This information management system not only helps to improve the quality and timeliness of nosocomial infection data collected in NNIS, but it also assists infection control practitioners in conducting more effective and efficient surveillance in their institutions. Second, additional hospitals are being added to the surveillance system so that the data

obtained will be from a more representative sample of all acute-care hospitals in the United States. Since recruitment began in March 1985, 10 hospitals have been added and additional hospitals are being considered for enrollment. Third, in July 1985, the feasibility of collecting data on antimicrobial usage in NNIS hospitals was assessed. Hospitals with computerized pharmacy records wishing to participate in the study will report on the use of antimicrobial agents so that for selected nosocomial bacterial pathogens the relationship between usage and resistance can be evaluated. Fourth, strategies are being developed for determining a more sensitive indicator of patients' risk based on characteristics of both the patient and the hospital (such as the three size categories used in this report). When various levels of nosocomial infection risks can be calculated, infection rates among hospitals can be compared and the distribution of risks can be standardized; in addition, hospital-specific infection rates and secular trends can be evaluated more effectively.

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